Feb. 1, 1938. G. F. DALY 2,107,143

TABULATING MACHINE

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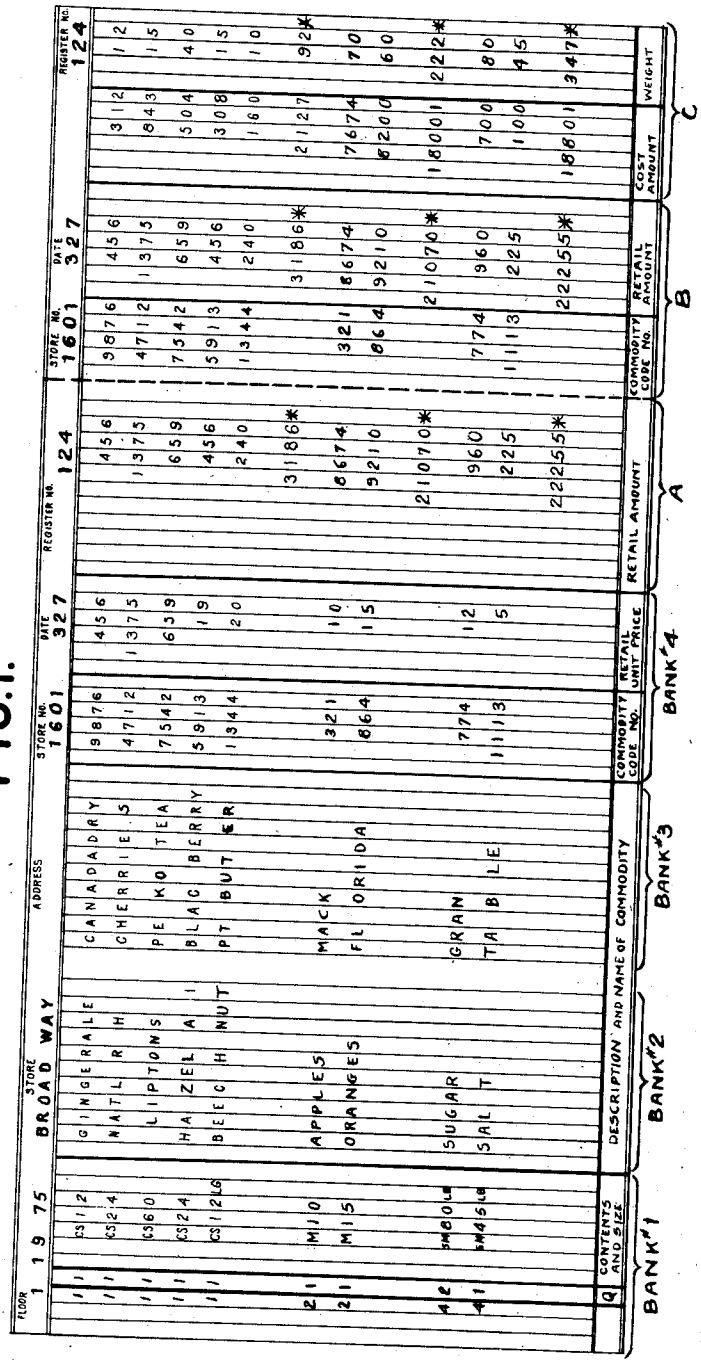
FIG. 1.



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TABULATING MACHINE

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FIG.2.

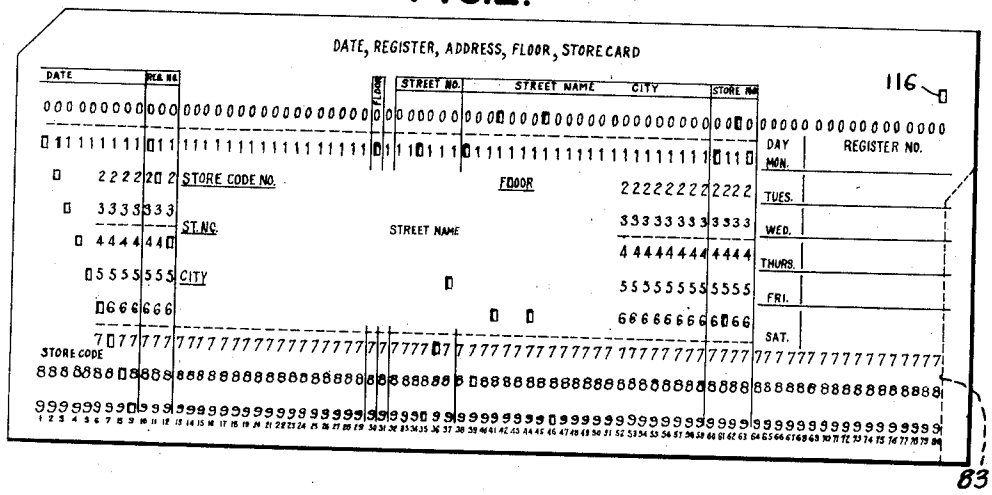


FIG.3.

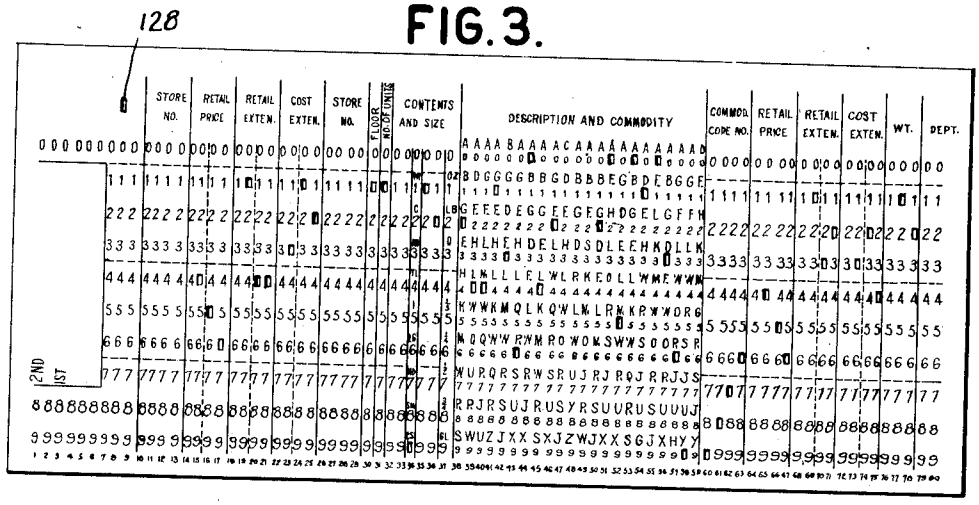
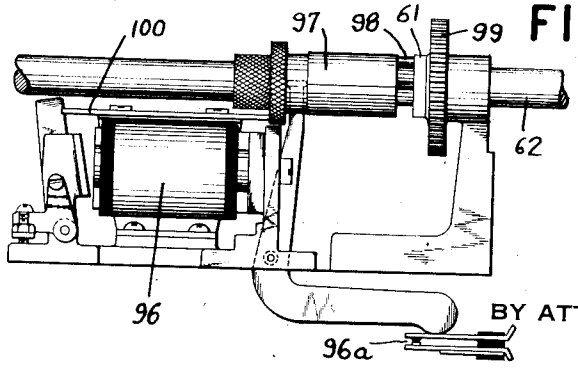


FIG.3a.



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TABULATING MACHINE

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FIG.4.

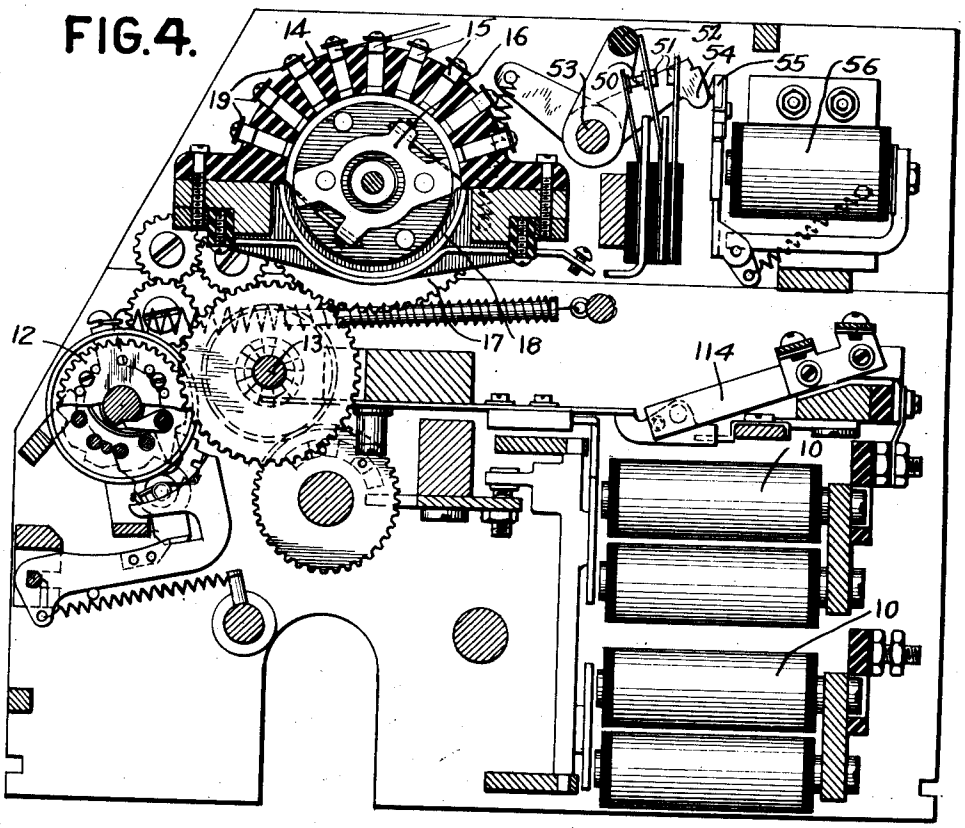

FIG.5.

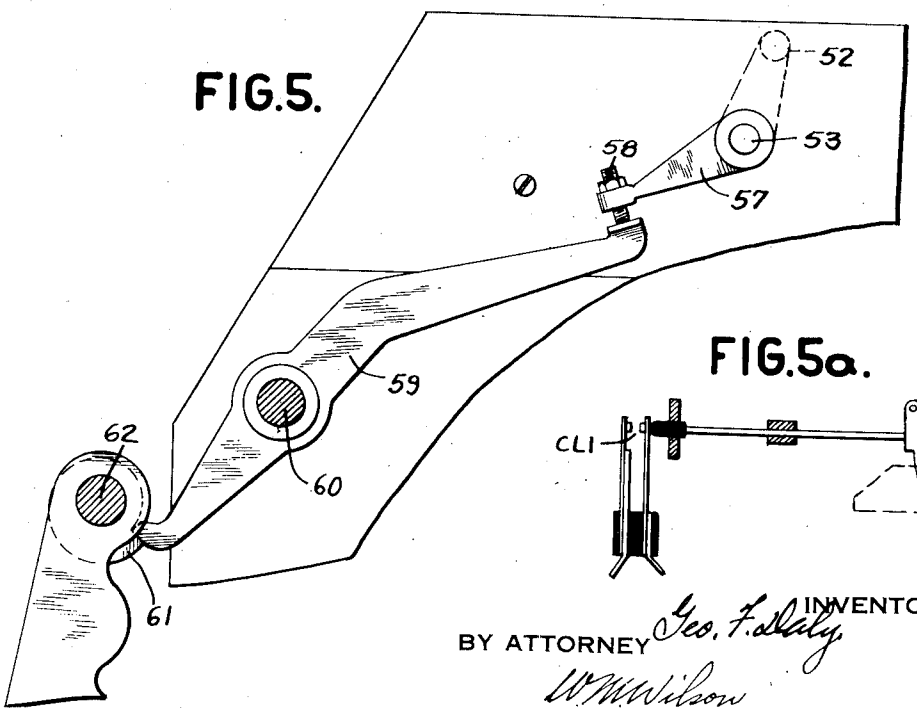

FIG.5a.

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FIG.6.

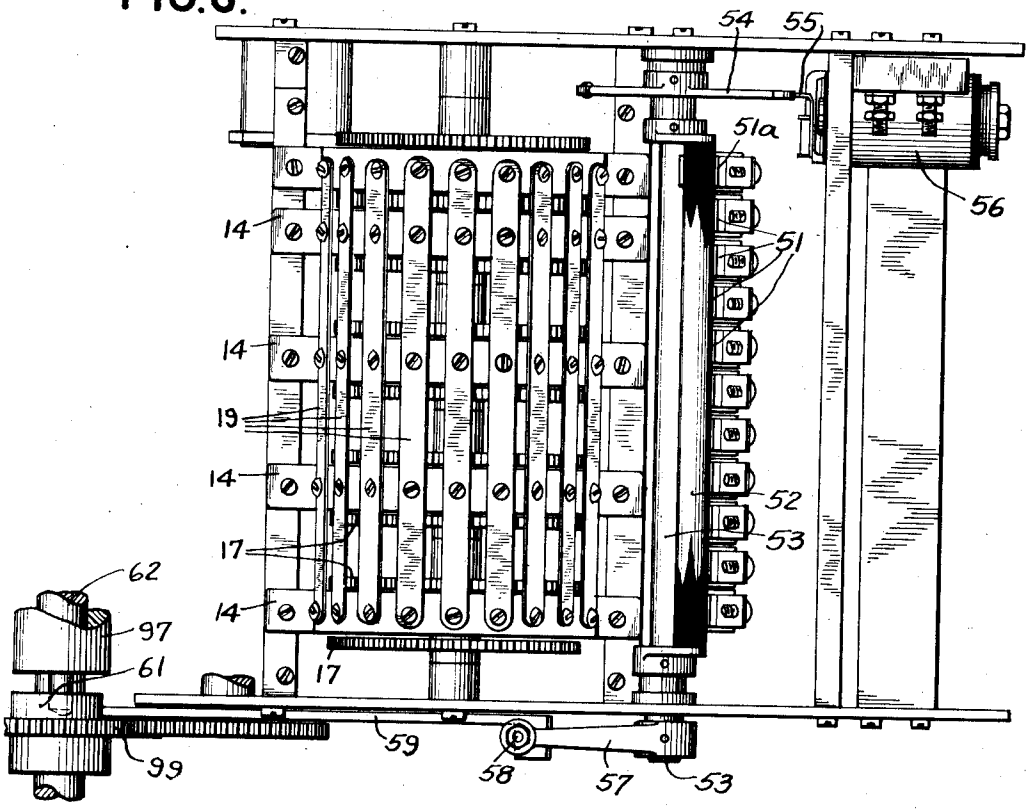

FIG.7.

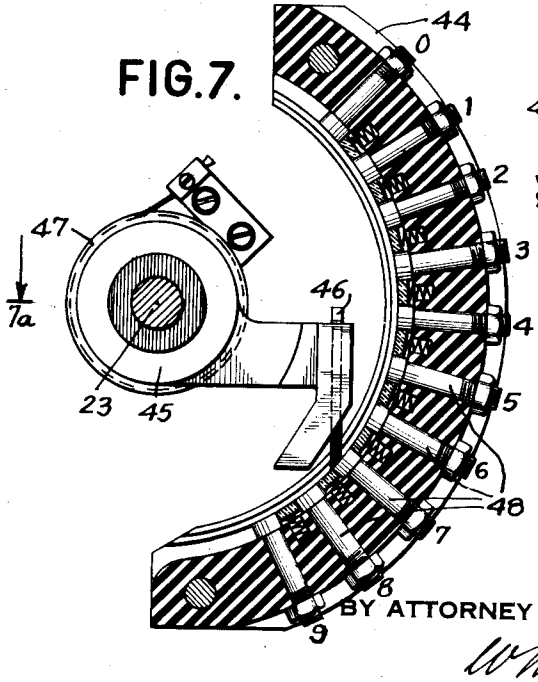

FIG.7a.

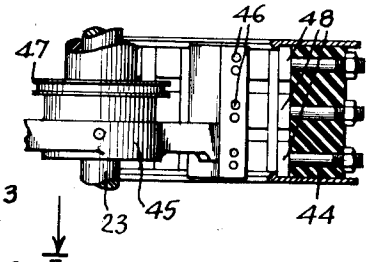

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FIG.8.

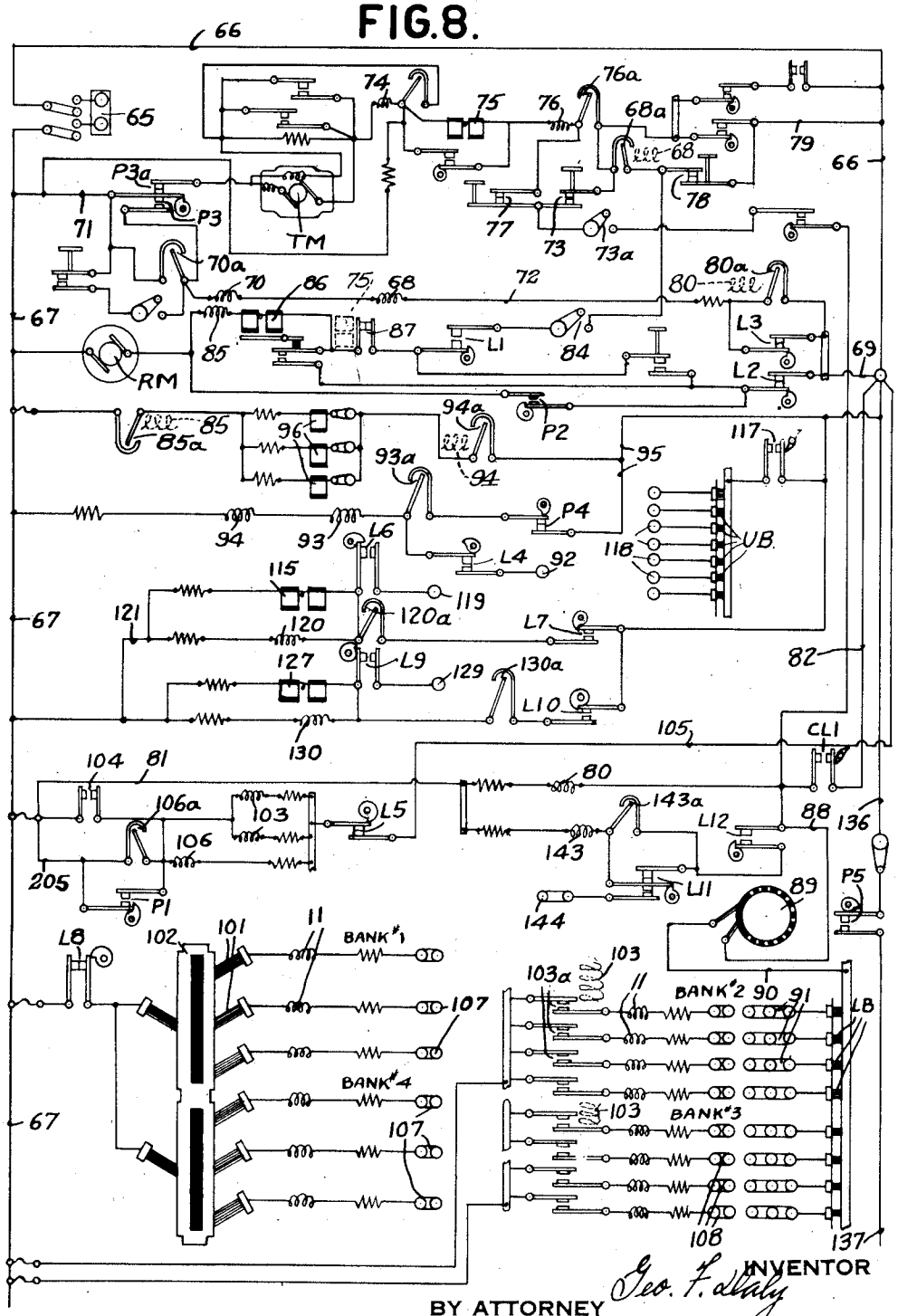

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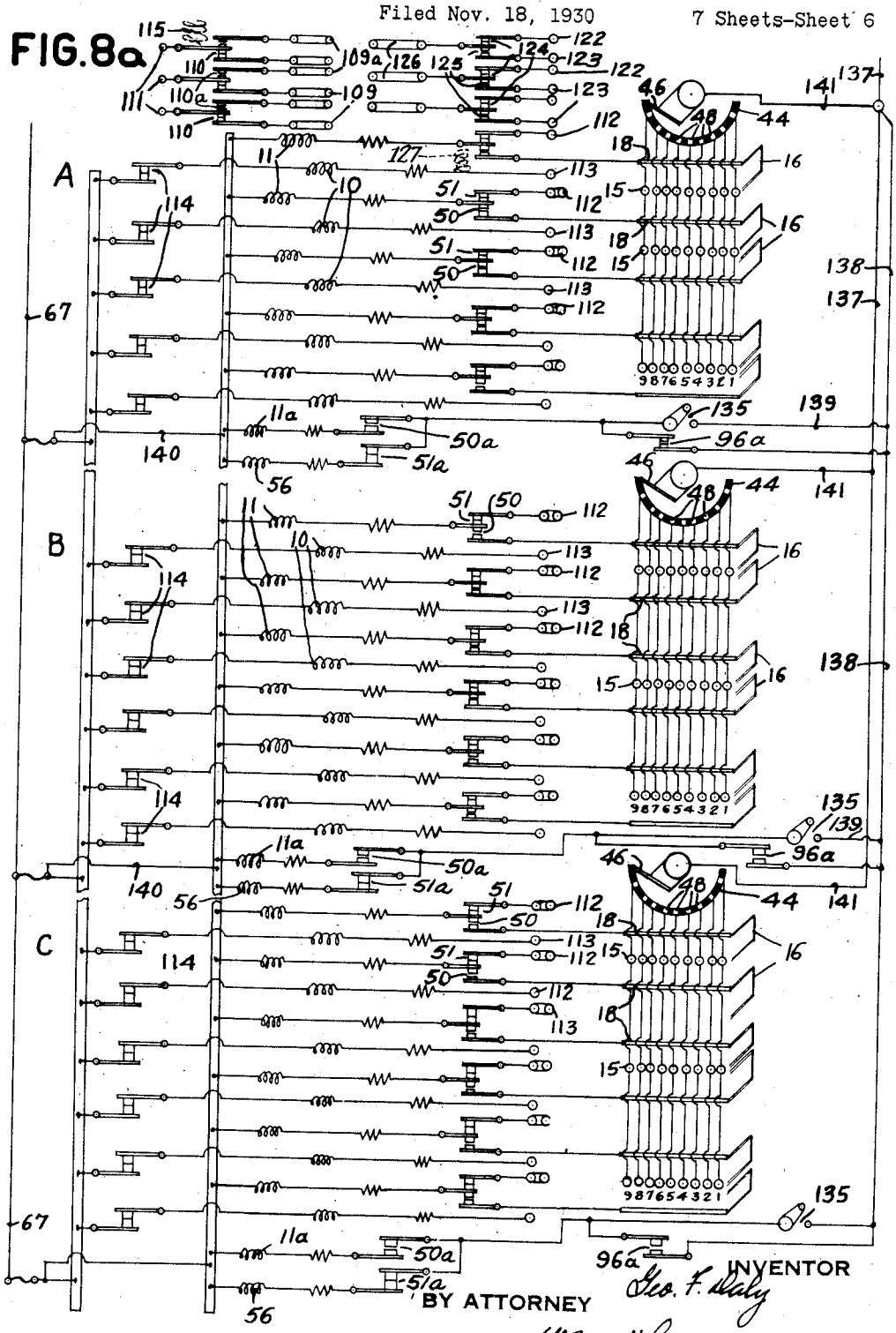
FIG. 8a



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TABULATING MACHINE

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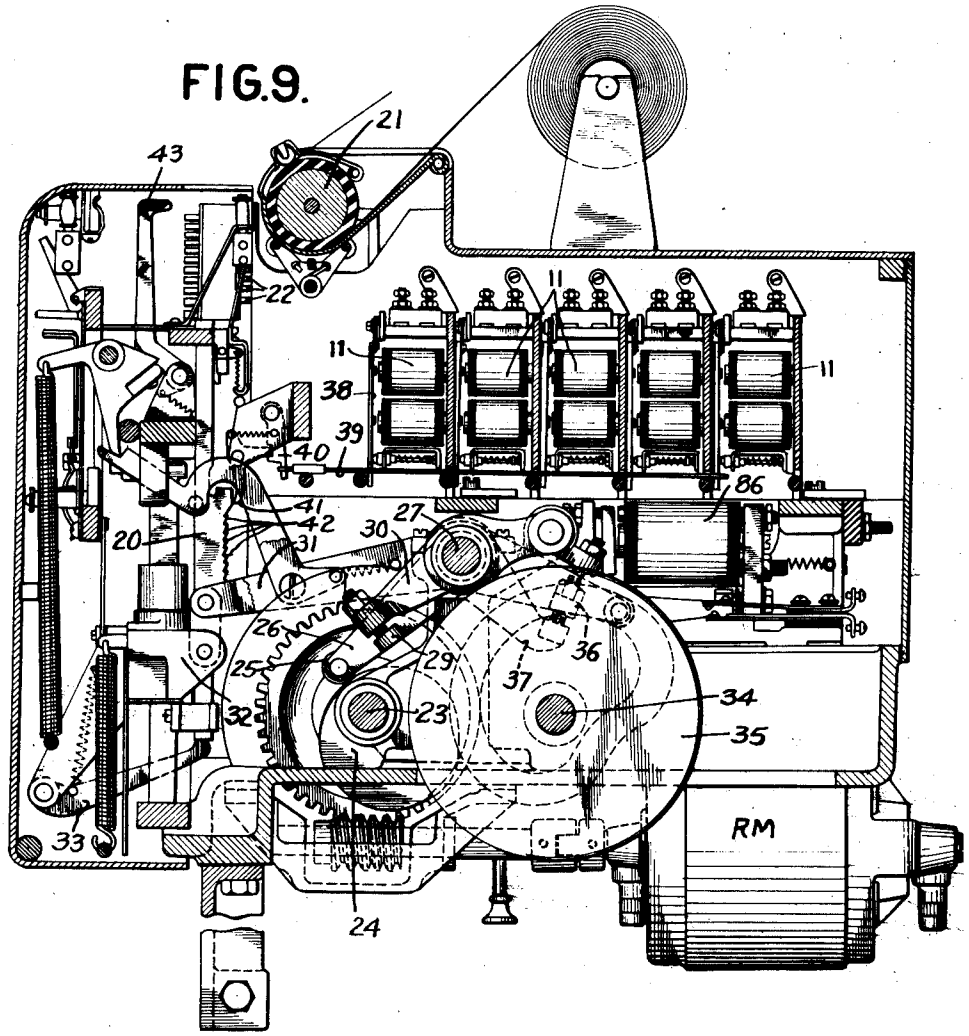
FIG.9.



Inventor

Geo. F. Daly

By his Attorney

W. M. Wilson

Patented Feb. 1, 1938 2,107,143

UNITED STATES PATENT OFFICE

2,107,143

TABULATING MACHINE

George F. Daly, Johnson City, N. Y., assignor, by mesne assignments, to International Business Machines Corporation, New York, N. Y., a corporation of New York

Application November 18, 1930, Serial No. 496,437

1 Claim. (Cl. 235—61.6)

This invention relates to accounting machines and more particularly to accounting machines of the perforated card controlled type.

It has for its principal object to provide additional selective features to such machines and to improve certain mechanical constructions to increase the efficiency and extend the utility of such machines.

A more specific object of the invention is to provide an automatic selecting mechanism to determine from which of a plurality of predetermined data fields of a card information is to be transferred to a common accumulating device.

A further specific object is to construct a total taking mechanism including switching devices so designed as to be more rapid in operation, positive in action and to require a lesser amount of energy to operate than heretofore.

Another specific object is to provide a so-called first card elimination device to automatically permit the transfer of data from the first card of a group of cards to a record sheet without entry of such data in the registering mechanism and to cause the data on succeeding cards to be transferred to the record sheet and printed in the same columns as the first card data, at the same time causing the data to be entered in accumulators.

Another specific object is to provide a tabulating machine controlled for automatic operation by control cards inserted between groups of data cards.

Various other objects and advantages of my invention will be obvious from the following particular description of one form of mechanism embodying the invention or from an inspection of the accompanying drawings; and the invention also constitutes certain new and novel features of construction and combination of parts hereinafter set forth and claimed.

In the drawings:

Fig. 1 is a specimen of an invoice prepared by the machine.

Fig. 2 is a specimen of a master card for controlling the printing of data on the invoice of Fig. 1.

Fig. 3 is a specimen of a detail card.

Fig. 3*a* is a detail of a reset clutch device.

Fig. 4 is a central section through the improved counter and total taking mechanism.

Fig. 5 is a detail of a restoring device for the total taking mechanism.

Fig. 5*a* is a detail of a card lever contact.

Fig. 6 is a plan view of Fig. 4, certain parts being omitted.

Fig. 7 is a detail of an impulse emitter.

Fig. 7*a* is a section taken on line 7*a*—7*a* of Fig. 7.

Figs. 8 and 8*a* taken together form a complete wiring diagram of the electric circuit of the machine.

Fig. 9 is a section through the printing section of the machine.

In order that the detail description may be followed to better advantage, a general statement will be herein given of the operation of the machine in connection with a specific application and the system of operation will be described as being applied to a mercantile warehouse invoicing system, but it is understood that the invention may with equal facility be used in any other commercial establishment and in many other relations.

In certain chain store systems where goods are stored in central warehouses, shipments are made from time to time to the branch stores and an invoice of each shipment is prepared to correspond to the articles so shipped. Two kinds of cards are used in preparing these invoices. A master card as in Fig. 2 bears store identifying data such as the address of the receiving branch and its number, the date of the invoice, store register number, etc. This card is used to control listing on the first line of the invoice (Fig. 1). Some of the data is duplicated on the right of the invoice sheet which may later be severed to provide duplicate records, one to be retained at the warehouse and the other to accompany the shipment. The second kind of card (Fig. 3) is a detail card bearing data concerning separate items such as description of the article, code number, retail price, retail and cost extension, weight, contents, size, etc.

Each of the detail cards is perforated to indicate the floor of the warehouse from which the article to which it corresponds was removed. It also bears perforations indicating the branch store for which the article is destined. Preparatory to invoicing, the detail cards are run through electric sorting machines which segregate them into groups in accordance with their punched store numbers. These groups are further sorted into sub-groups comprising cards having the same floor number. A main group of cards which is to control the preparation of a single invoice is then arranged to be headed by its associated master card followed by the successive floor groups of detail cards. Between each floor

group is placed a well-known control card and at the end of a store group is placed a special control card. Other store groups then follow in the same order.

In operation, the master card of a store group is fed through the machine and the data thereon transferred to the first line of the invoice, none of this data being entered into the accumulating mechanism of the machine. The items on the following detail cards are then successively listed and certain data thereon entered into appropriate accumulators. At the end of a floor group the inserted control card will cause the machine to perform an automatic total taking cycle of operations during which the invoice is spaced and a total is printed of the items in the group, this total being retained in the accumulators. Spacing again takes place after this printed total and the next floor group is similarly listed, the control card at the end thereof again initiating an automatic total taking cycle. The total printed will be a progressive total, that is, the sum of both groups of detail cards. This printing and totaling of subgroups continues until the last group has been listed whereupon the special control card at the end thereof will automatically initiate a total taking cycle wherein a final or grand total is printed and the accumulators zeroized. The machine then comes to rest, if the special control card is the last card in the magazine, to permit removal of the invoice and the insertion of a new sheet. The various control cards may, if desired, be caused to bring the machine to a stop to permit insertion of a new sheet and the total operations may be manually initiated.

Each of the detail cards is provided with duplicate fields headed "Retail price", "Retail exten." and "Cost exten." and the fields on the right of the card are normally perforated with the appropriate data. Where the price of the article changes after the card has been prepared the new data is entered on the fields on the left of the card and a special hole is punched in the "X" index point position of a predetermined column to indicate that the new data is to prevail. The "X" hole will cause the machine to sense the data on the left of the card and disregard that on the right. This arrangement obviates the necessity of preparing an entire new detail card when a price change occurs in a commodity.

The improvements have been shown as applied to an electrical tabulator of the type disclosed in Patent No. 1,762,145, issued to Daly and Page. Each counter wheel of the accumulator may be provided with a commutator having a segment corresponding to each significant figure indication of the counter wheel. A brush may be geared to the counter wheel so that it always rests on the commutator segment corresponding to the digit reading of the wheel. Each of these brushes may be connected to a printer magnet to select the proper type for printing during total taking. An impulse emitter is provided for each accumulator bank coordinated with nine separate lines so as to emit an impulse to each line at a point in the machine operation corresponding to the digit value which they represent. Thus the "9" line receives an impulse timed to select a nine for printing, the "8" line receives an impulse timed to select the eight type for printing and so on. All the commutator segments of an accumulator bank corresponding to the "9" position of the counter wheels are connected to the "9" impulse line from the emitter corresponding to that bank. All the "8" segments are likewise connected with the "8" line and so on.

The diagram in Figs. 8 and 8a illustrates the wiring of the complete machine. During listing and adding operations the machine is driven by a tabulating motor TM controlled by a group of cam and relay controlled circuits to be traced later and during total taking operations the machine is driven by a reset motor RM controlled in a manner to be explained. When the tabulating motor TM is in operation it feeds the perforated tabulating cards, bearing differentially arranged index points representing digits, first beneath the upper analyzing brushes UB and one machine cycle later beneath the lower analyzing brushes LB.

As the perforated cards pass the lower brushes their index points instantaneously close circuits through the proper lower analyzing brushes LB to energize counter magnets 10 or printer magnets 11 or both together. As usual the timed energizations of these magnets control mechanism for entering the data corresponding to the card reading on the counter wheels or stopping the type bar at the corresponding printing position. In this fashion the accumulated items may be listed. These functions do not enter specifically into the present invention and will not be described in detail as they are well understood and fully described in the patent previously mentioned.

Referring now to Fig. 4, the counter wheels are represented by gears 12 driven from a shaft 13 under control of the counter magnets 10 as previously stated. As usual indicating wheels are provided fixed to the counter wheels so that data entered on the counter wheels may be visually indicated.

The total taking mechanism shown in the upper part of Fig. 4 and in Fig. 6 consists of a commutator 14 provided with segments 15 corresponding in number and position to the several digit indicating positions of the counter wheel 12. A brush structure 16 is mounted on a gear 17 driven by the gear which drives the counter wheel 12 so that the brush structure is angularly displaced according to the reading on the counter wheel. The structure carries two brushes, one of which engages the segments 15 and the other of which engages a common segmental conductor 18 whose surface corresponds to the configuration of the commutator. All of the segments 15 corresponding to the same digit are connected to a common conducting bar 19 whereby all the "9" segments are in multiple, all the "8" segments are in multiple, and so on. This total taking mechanism is more fully shown and described in Patent No. 1,921,454, issued to G. F. Daly, August 8, 1933.

In Fig. 9 is shown the printing mechanism through which the type bar 20 is positioned relatively to the platen 21 to bring the proper type 22 into printing position opposite the platen. The total shaft 23 driven by the reset motor RM is provided with a cam 24 cooperating with a roller 25 carried on arm 26 freely rotatable on shaft 27. As the cam rotates arm 26 rocks clockwise and a lug 29 cooperating with an arm 30 fixed to shaft 27 also rocks clockwise. Arms 31 also fixed to shaft 27 are linked to printing crosshead 32 which serves to raise the type bar 20 in synchronism with the total taking operation so that the type 22 successively pass printing position opposite platen 21. Owing to the spring operated scissors connections 33, however, the type bars 20 may be arrested in any printing position without interfering with the upward movement of crosshead 32.

During card feeding operations shaft 34 is driven by the tabulating motor TM (Fig. 8) and is provided with a box cam 35 cooperating with a follower arm 36 loosely mounted on shaft 27. This arm cooperates with an arm 37 secured to shaft 27. In this manner crosshead 32 is elevated during listing operations by cam 35 to bring the type 22 successively to printing position in synchronism with the movement of the corresponding index point positions past the lower brushes.

The type bars are arrested under control of the printing magnets 11. When one of these is energized it attracts its armature 38 and pulls a call wire 39 to the right thereby releasing a latch member 40 normally holding stop pawl 41. When the pawl 41 is so released it is spring operated to engage ratchet teeth 42 cut on the type bar 20 to prevent further upward movement of the type bar thus holding a particular type 22 in printing position. Printing hammers 43 are subsequently tripped to impel the selected type against the platen 21.

The device for emitting the timed impulses synchronized with the movement of the type bars 20 to select the type for printing during a total taking operation is shown in Figs. 7 and 7*a*. This consists of a number of individual commutators 44 located adjacent to the total shaft 23. A brush holder 45 is secured upon shaft 23 and insulated therefrom. The holder carries a plurality of brushes 46, one for each commutator, which receive current through a collector ring 47 integral with holder 45. Each commutator is provided with a plurality of contact segments 48, so spaced that the brush 46 reaches a segment 48 as the type corresponding to it on type bar 20 is passing printing position during a total printing cycle. Each commutator 44 is associated with a separate bank of accumulating elements and each segment 48 is electrically connected with the bars 19 connecting the common commutator segments 15 of Figs. 4 and 6.

Hence it will be understood that each set of commutator segments 15 in an accumulator bank receives a timed impulse at the time when the type corresponding to the segment is passing the printing line. In Fig. 8*a* these devices have been shown diagrammatically and their detailed functions will be traced in connection with the description of the circuit.

A circuit switching device is provided in Figs. 4 and 6 which is adapted to open the listing circuits and close the totaling circuits at the beginning of a total taking cycle of operations. This consists of a plurality of three-spring contacts forming contacts 50 and 51 in series with the circuits of printer magnets 11 (see Fig. 8*a*). A common bail 52 of insulating material is secured upon a shaft 53 which also carries a spring pressed latching arm 54 adapted to be latched by an armature latch 55. In latched position the bail 52 will hold contacts 51 closed and contacts 50 open.

Energization of a magnet 56 will release arm 54 and the parts will assume a position as shown in Fig. 4 wherein contacts 50 are closed and contacts 51 open. In Fig. 5, shaft 53 carries an arm 57 at its extremity which has an adjustable stud 58 in its free end in engagement with an arm of a lever 59 loosely pivoted at 60. The other arm of the lever cooperates with a cam 61 secured upon reset shaft 62. This shaft, as is fully explained in the patent referred to, is adapted to make a complete turn during the latter half of a total taking cycle of operations to zerize the counters. At such time cam 61 will rock arm 57 through lever 59 to turn bail 52 in a clockwise direction whereupon latch 55 will engage and hold arm 54.

A contact 51*a* is adapted to close with contacts 51 to energize a printer magnet 11*a* (see Fig. 8*a*) for controlling the printing of an asterisk together with the totals. A contact 50*a* is adapted to open with contacts 50, to break the circuit to magnet 56.

The foregoing briefly describes the operation of the counting and printing mechanisms as carried out in the patent referred to with the exception of the total printing operation which in the present instance is controlled by commutator devices as explained.

Wiring diagram

The steps involved in the operation of the machine to prepare the invoice of Fig. 1 will now be traced. The invoice sheet having been inserted with the first line in printing position, the cards are placed in the hopper in the order outlined, with the master card at the head of its associated group.

Referring now to Figs. 8 and 8*a*, current is supplied from source 65, to lines 66 and 67. During the last previous operation of the machine cam contacts P3 and L3 closed to establish a circuit through motor control relay coil 68 as follows: From line 66, wire 69, contact L3, wire 72, coil 68, holding-relay coil 70, contact P3, wire 71, to line 67. Energization of coil 70 attracted its armature to close points 70*a* forming a stick circuit from coil 70, points 70*a*, wire 71, to line 67, thus shunting contact P3. Contacts L3 continue closed and remain so after the machine has come to rest, consequently coil 68 is energized in preparation to permit restarting of the machine and holds its points 68*a* closed.

Depression of start key 73 will complete a circuit as follows: From line 67, wire 71, contact P3*a*, motor TM, relay coil 74, card feed clutch magnet 75, motor relay 76, stop key contacts 77, start key contacts 73, relay points 68*a*, stop key contacts 78, wire 79 to line 66. Cards proceed to feed through the machine and as the first card passes the lower brushes LB the usual card lever contact CL1 is closed closing a circuit through a card lever relay coil 80 from line 67, wire 81, coil 80, contacts CL1, wire 82 to line 66. The points 80*a* of relay coil 80 close to form a shunt circuit around contact L3 which opens while the card is passing the lower brushes to maintain the circuit through coils 70 and 68. Feeding of cards will continue until the supply is exhausted or until a control card presents itself to the lower brushes. Such card may be unperforated and have a cut-away section as at 83 in Fig. 2 traversing the plane of the card lever so that the contact CL1 will open and permit deenergization of coil 80. Points 80*a* will consequently open but contacts L3 are closed thus holding the circuit until another cycle is initiated. At the time at which the "8" index point positions of the records are sensed by the analyzing brushes, contacts L3 open while points 80*a* are still open deenergizing coil 68 to stop motor TM due to the opening of points 68*a*. This extra cycle serves to pass the control card completely through the machine.

If switch 84 is open the machine will stop, but if the switch is closed an automatic total taking cycle will ensue. The circuit completed follows from line 67, reset motor RM, relay coil 85, reset

clutch magnets 86, contact 87 (closed when magnet 75 is deenergized) cam contacts L1 (closed momentarily before the machine comes to stopping position), switch 84, contact 78, wire 79 to line 66. The magnet 86 is short circuited by the usual cam contact P2 which holds the circuit through motor RM from line 67, motor RM, contact P2, contact L2, wire 69 to line 66, and breaks at the proper time to bring the parts to rest in normal position. The total taking cycle so initiated will cause the printing of a progressive total, that is, the amounts standing in the accumulators will be read out and printed but the accumulators will not be zeroized. If the machine is stopped, a new sheet may be inserted and total printing thereon dispensed with.

The special control card placed at the end of a number of groups of cards is perforated with a hole in the "11" or "X" index point position of a predetermined column in addition to having a cut-away portion 83. The normal and special control cards thus each have the cut-away portion 83 which causes the machine to discontinue card feeding and enter upon total taking operation. The control cards are generally blank otherwise, but may contain printed identifying information, if desired. The hole in the special control card is sensed by the lower brushes as the control card is passing and a circuit is completed as follows: line 66, wire 82, contact CL1 (now closed), wire 88, impulse distributor 89, wire 90, lower brush LB, hole in the card to plug socket 91, thence through a suitable plug connection to plug socket 92, cam contact L4, closed at this time, relay coils 93 and 94 to line 67. A holding circuit follows from line 67, coils 94, 93, points 93a of coil 93 which are now closed, cam contact P4, wire 95 to line 66. P4 breaks this circuit during the total taking cycle. Closure of points 94a due to energization of their coil 94 completes a circuit (generally known as the counter canceling circuit) from line 67, relay points 85a (previously closed due to energization of coil 85), parallel zero button magnets 96, points 94a, wire 95 to line 66. Energization of magnets 96 of which there is one for each accumulator bank, will in a well known manner cause the clutching of the counter wheels to the reset shaft 62 for restoration of the former to zero position. Since relay coil 85 is in series with reset clutch magnet 86, points 85a and consequently magnets 96 will be energized before the reset mechanism actually begins to operate under control of motor RM. Energization of each magnet 96 will also close an associated contact 96a (Fig. 8a). The reset clutch is shown in Fig. 3a as comprising clutch element 97 rotatable with cam 61 secured to shaft 62 and slidable along the shaft to move a pin 98 into a suitable opening in gear 99. Energization of magnet 96 will cause its armature to slide a member 100 to the right to cause engagement of the clutch elements. Movement of member 97 to the right will close contact 96a through a suitable bell crank connection as shown. If the automatic restart switch 72a (Fig. 8) is closed, the machine will automatically enter upon a card feeding cycle immediately upon completion of a total and reset cycle. The circuits involved are well known and hence require no detailed explanation here. They are similar to those shown in Patent No. 1,762,145, issued to Daly and Page, June 10, 1930.

The machine is provided with four listing banks indicated in Fig. 8 as bank #1, bank #2, bank #3, and bank #4. Banks #1 and #4 are the usual banks which when the machine is not listing, have their associated brushes 101 on an insulated portion of commutator 102. It will be noted in machines of the character disclosed in the patent referred to that each of the several banks of type bars are capable of being sub-divided into banks of lesser capacity by means of the usual zero suppression devices. Thus banks #1, #4, B and C are split to afford the several columns of items shown in Fig. 1. Banks #2 and #3 have a contact 103a in series with each printer magnet 11. These contacts constitute a multi-contact relay operated by magnets 103 and are closed only when the machine is set for listing. When tabulating these contacts 103a are open and banks #2 and #3 are inoperative. In Fig. 8 contacts 104 are closed when the machine is set to list and each closure of cam contacts L5 will energize magnets 103 to close their contacts 103a through the circuit from line 67, contacts 104, magnets 103, contacts L5, wire 105 to line 66.

When the machine is set for tabulating only, contact 104 will, of course, be open and banks #2 and #3 will be inoperative. During any total taking cycle of the machine cam contacts P1 close at a time when contact L5 is closed and a circuit is established from line 67, wire 205, contact P1, relay coil 106, cam contact L5 and back to line 66. Energization of coil 106 closes its points 106a and a circuit is established from line 67, wire 205, points 106a, multi-contact magnets 103, contact L5, back to line 66. In this manner the contacts 103a are closed so that the first card of the group may be listed. Thereafter contacts L5 open and the holding circuit to magnets 103 is broken.

The machine is also provided with three accumulating banks indicated at A, B, and C in Fig. 8a. Each accumulating bank is provided with a plurality of counter magnets 10 connected to individual plug sockets 113. A plurality of corresponding printer magnets 11 are also provided which are connected through contacts 50 and 51 to individual plug sockets 112 and the conductor bars 18 of the total taking mechanism respectively.

Plugging connections

The various connections will now be traced from the brush columns to the printing positions in accordance with the examples selected. As has already been pointed out, for tabulating operations, the master or address card precedes the group of detail or commodity cards, the master card listing across the entire top of the invoice. Inasmuch as no information on this master card is to be added, it is necessary to plug all information to the counters through a so-called elimination device, which will prevent addition of any amounts from the master card. It will be noted in comparing Figs 1, 2, and 3 that information contained in columns 30 to 59 inclusive of both the master and detail cards is to be listed in the same printing banks and in the same order, namely in banks #1, #2 and #3 and the plugging may therefore be made directly from the plug sockets 91 of these columns to the sockets 108 of the printer magnets 11 of the proper printing banks. Columns 60 to 63 are plug connected to the printer magnets of the left half of bank #4 and also to the printer magnets of the left half of counter B.

In Fig. 1 the banks or counters through which the various columns of data are printed have been indicated and an inspection of the cards

(Figs. 2 and 3) will disclose that the fields of the invoice for which plug connections have thus far been pointed out, derive their data from columns of the master and detail cards having the same lateral allocation. Thus the same group of brushes which read store and address from the master card will also read description and name of commodity from the detail card. The alphabetical characters are obtained by replacing the usual numerical type with others having type corresponding to those shown adjacent to index point positions of the card in Fig. 3.

The plug sockets 91 corresponding to the brushes which read columns 64 to 75 are connected to plug sockets 122 and the sockets 91 corresponding to the brush columns 14 to 25 are connected to plug sockets 123. These sockets are connected to multi-contact relay switches comprising sets of normally closed contacts 124 and normally open contacts 125, the common blade of each of which is connected to a plug socket 126. A plug connection is made between sockets 126 and plug sockets 113 of the counter magnets 10 of counters A, B, and the left half of C so that the data relating to retail price, retail extension, and cost extension may be accumulated in these counters.

The relay contacts 124 are normally in the position indicated in Fig. 8a and are adapted to be shifted to their alternate position by a relay magnet 127 (see also Fig. 8). As has been previously explained, either the data from the right section of the card of Fig. 3 or the left section is to be entered into the counters. If the left section is to be recorded, the detail card is perforated with a special "X" hole indicated at 128. During the passage of the card by the upper brushes UB, if the plug 118 of the column in which the perforation appears is plug connected to a socket 129, a circuit will be established through magnet 127. This circuit follows from line 66, contact 117, perforation in the card, upper brush UB, socket 118, connection to socket 129, contact L9, closed at this time, magnet 127, to line 67. This circuit will branch from contact L9, through a holding relay 130, so that a stick circuit will be established from line 67, through coil 130, its now closed points 130a, cam contact L10, back to line 66.

The timing of cam L10 is such that magnet 127 will remain energized until the card has passed the lower brushes. Energization of the magnet will shift the associated multi-contacts so that contacts 124 are opened and contacts 125 are closed. Where no such special perforation appears in the detail card, contacts 124 are closed and the data from the right section of the card will be entered. The plug sockets 91 of columns 76 to 78 are connected to the printing sockets 112 and also the counter sockets 113 of the right half of counter C so that this data may be appropriately listed and accumulated.

Where the master card of Fig. 2 contains perforations in the columns in which the detail card has data to be accumulated, it is necessary to disconnect these columns from the counters during the passage of the master card by the lower brushes in order to prevent the entry of this unrelated data into the counters. In such event the sockets 91 of the columns having data to be accumulated or sockets 126 are connected to plug sockets 109 connected to normally closed multi-contacts 110. Sockets 111 may then be connected to the particular counter columns in which the data is to be entered.

Each master card is provided with a special perforation 116 in the well known "X" position which is sensed by the upper brushes UB. A plug connection is made between the corresponding plug socket 118 and a socket 119 and upon sensing of this perforation a circuit will be established from line 66, contact 117, perforation in the card, socket 118, plug connection to socket 119, cam contact L6, closed at this time, magnet 115, wire 121, to line 67.

A parallel circuit extends through relay magnet 120 causing closure of its points 120a and the establishment of the stick circuit as follows: line 67, wire 121, coil 120, points 120a, cam contact L7, back to line 66. Contact L7 is timed to maintain magnet 115 energized until the card has passed the lower brushes. In Fig. 8a energization of magnet 115 will open contacts 110 so that no circuits will be completed to the counter magnets 10 during the sensing of the master card by the lower brushes. In series with each counter magnet 10 is the usual normally closed circuit breaker contact 114 (see also Fig. 4) which opens to break the counter circuit upon energization of the magnet 10.

Total printing

In certain instances, information must be listed from a field of the master card to a particular section of a printing bank, and this same section of a printing bank must list detail amounts from a detail card field which does not correspond in lateral allocation with the master card field. A particular example of this will be noted in the right half of column C in Fig. 1 wherein "Register No." is listed from columns 10–12 of the master card and "Weight" is listed from columns 76–78 of the detail card. And again in column A wherein "Register No." is listed from columns 10–12 of the master card and "Retail extension" is listed as "Retail amount" on the invoice from either columns 18–21 or 68–71 of the detail card. Since the brush plugs of the brushes reading these columns on the detail cards are connected to both list and add magnets and the brushes reading the master card are connected to list magnets only, it is possible, without the use of circuit breakers in the adding circuits to obtain back circuits which would cause erroneous entry of data from the master cards into the accumulating mechanism.

To obviate this condition, all such adding circuits have a contact 110 plugged in series therewith, and since these contacts are open during the sensing of a master card by the lower brushes no adding circuits can be completed.

To prevent certain brushes from listing during the sensing of detail cards, which are to list only from a master card, contacts 110a are provided which are plug connected in series with such listing circuits. These contacts close during the passage of the master card by the lower brushes and are open at other times under control of relay coil 115.

In obtaining the "date" from the master card (Fig. 2) it will be observed that nine columns are allotted to this entry and the field is punched 123456789. All master cards are automatically prepunched in this same manner, and since the date to be printed is usually the date the invoice is prepared, such date is to be selected from the punching shown by means of suitable plug connections. For example, to obtain such a date as November twenty-seventh, the columns in which "11" is to be printed are both plugged to the

brush position which reads the "1". "2" is obtained by plugging to the column having such punching and similarly "7" is obtained from column 7. In this manner by suitable single or multiple plug connections any date may be obtained from the common setup. The operator need merely make the connections corresponding to the date desired and obviates the necessity of punching the date in the master card.

After the information on the master card has been printed on the invoice and the detail cards of the first group have been individually listed and items thereon entered into appropriate accumulators, the control card at the end of this first group will cause the machine to enter upon an automatic total taking cycle in a manner already explained. During this total taking cycle of operations, those of the accumulator banks A, B, or C that have their progressive total switch 135 closed, will print the amounts standing in such accumulators without clearing. It may here be explained in connection with the circuit diagram that those cam contacts which operate during listing operations are prefixed L and are controlled from list shaft 34 of Fig. 9. Those cam contacts prefixed P are controlled from total shaft 23 and function only during total taking operations.

Upon the initiation as just stated of a total taking cycle, cam contact P5 (Fig. 8) will close establishing a circuit from line 66, wire 136, cam contact P5, wire 137, wire 138, wires 139, closed switches 135, closed contact 50a, magnet 56, and wires 140 to line 67. Energization of the magnet 56 as has already been explained in detail will cause unlatching of arm 54 (Fig. 4) to permit the shifting of contacts 50, 51 from the position shown in Fig. 8a thereby connecting the several printer magnets to the total taking commutator bars 18. At this time the commutator brushes 46 are rotating in synchronism with the elevation of the type bars and make contact successively with the various commutator segments 48.

Current is supplied from line 137, through wires 141 to brush 46, thence successively through segments 48 to the common lines connecting the segments 15, thence at the proper time through brush structures 16 to the corresponding conductor strips 18, contacts 51, printer magnets 11, wire 140, back to line 67. In this manner the various printer magnets 11 will be energized at a time corresponding to the angular position occupied by the related brush structure 16.

The timing of cam contact P5 is such that current is supplied to the commutators only during the upward movement of the type bars.

After the printing of the progressive total, listing and accumulating continues and the new amounts are added to those already standing in the accumulators so that upon presentation of the next control card a second progressive total will be printed.

The special control card at the end of the complete classification of store cards will, as has been explained, initiate a total and reset cycle during which the several zero button magnets 96 are closed to connect the several accumulator banks A, B, and C., to the reset shaft for mechanical resetting and the associated contacts 96a will also be closed to short circuit the switches 135. The magnets 56 will thus be energized through the following circuit: wire 138, contact 96a, contact 50a, magnet 56, wire 140, to line 67. The printing circuits will be the same as in the progressive total and after all the amounts have been read from the various accumulators the resetting mechanism will turn the counter wheels to zero position.

The machine is provided with mechanism for counting the number of cards passed through the machine exclusive of the control cards. To this end a double cam contact L11 is provided which is so arranged that the upper contact is closed, while the lower portion of the card is passing the card lever. If the card lever contacts CL1 are closed at such time, indicating the presence of a normal detail or master card, the card counter relay is set up and held through the remainder of the card cycle. This circuit follows from line 66, wire 82, contact CL1, cam contact L12, upper contact L11, relay coil 143, wire 81, back to line 67. The holding circuit will therefore continue from contact L12 through points 143a, relay coil 143, to wire 81. At the end of this card cycle card contact L12 opens causing the relay to drop. The lower contact L11 terminates in a plug socket 144 which may be connected to the socket 113 of a selected accumulator. This lower contact L11 closes at a time corresponding to the one index point position of the card and the circuit follows from line 66, wire 82, contact CL1, contact L12, relay points 143a, lower contact L11, socket 144, connection to socket 113, counter-magnet 10, contacts 114, to line 67. If a control card is under the brushes at the time contact L11 shifts to close its upper contacts, no circuit is completed and no adding circuit will be established to the selected counter.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claim.

I claim:

In a record controlled accounting machine, means for feeding record cards, normal control cards, and special control cards, said control cards having an irregular outline, and said special control card having in addition a special perforation in a predetermined position, an accumulator, means controlled by the record cards for entering amounts therein, total taking mechanism including normally ineffective resetting mechanism for said accumulator, means controlled by the irregular outline of said control cards for causing an operation of said total taking mechanism, and further means rendered effective by the special perforation in said special control card for causing said resetting mechanism to operate during a total taking operation.

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